(7) a) $V = \frac{1}{3}\pi r^2 h$ $\quad 4\pi \text{ in}^3/\text{sec}$ $\quad r = 2 \text{ in}$ $\quad \frac{dr}{dt} = \frac{1}{3}$

$V = 8\pi$

$h = 6 \text{ in}$

$A = \pi r^2$

$\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$

$4\pi\left(\frac{1}{3}\right)$

$\frac{dA}{dt} = \frac{4}{3}\pi \text{ in}^2/\text{sec}$

$\frac{dV}{dt} = \frac{1}{9}\pi h^2 \frac{dh}{dt}$

b) $V = \frac{1}{3}\pi r^2 h$ $\quad V = \frac{1}{3}\pi\left(\frac{h}{3}\right)^2 h$

$V = \frac{1}{3}\pi \frac{1}{9} h^3$

$V = \frac{1}{27}\pi h^3$

$4\pi = \frac{1}{9}\pi(6)^2 \frac{dh}{dt}$

$h = \frac{3V}{\pi r^2}$

$4\pi = 4\pi \frac{dh}{dt}$

$h = \frac{24\pi}{4\pi}$

$h = 6$ $\quad \frac{h}{r} = \frac{6}{2}$ $\quad \frac{h}{r} = 3$

$r = \frac{h}{3}$

$\frac{dh}{dt} = 1 \text{ in/sec}$

c) $A = \pi r^2$ $\quad r = \frac{h}{3}$

$A = \pi \left(\frac{h}{3}\right)^2$

$A = \pi \frac{1}{9} h^2$

$\frac{dA}{dt} = \frac{2}{9} \pi h \frac{dh}{dt}$

$\frac{dA}{dt} = \frac{2}{9} \pi (6)(1)$

$\frac{dA}{dt} = \frac{4}{3} \pi \text{ in}^2/\text{sec}$

c) $\frac{dA}{dh} = \frac{dA/dt}{dh/dt} = 4\pi/3 \text{ in}^2/\text{sec}$

Must Do

42, 53, 62, 71, 72

Linearization

27-29, 39

Optimization

45-57

Related Rates

58-65

(45)

$100 = s + 2r$ $\quad s = 100 - 2r$

$r = 2s$

$100 = s + 50$

$s = 50$

$A = C \pi r^2$

$\frac{s}{2\pi r}$ 1

$A = \left(\frac{100-2r}{2\pi r}\right)\pi r^2$

$A' = 2r\left(\frac{100\pi r^2 - 2\pi r^3}{2\pi r}\right)$

$A' = 50r - r^2$

$A' = 50 - 2r$

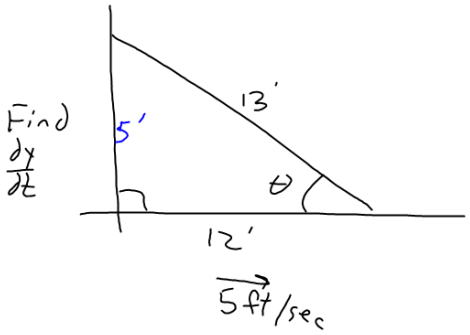
$B = 50 - 2r$

18 - Sienna, Jackie, Geoff, Casey
20 - Nick, McKenzie, Dustin
21 - Nathan, Vy
27 - Chris, Max, Brett
30 - Mike, Colt, Scott T.
34 - Scott H., Charlie H., Kemi, Jordan

HW do these

come tomorrow with ?'s pretend to study

4.6 #19



$x^2 + y^2 = 169$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2(12)(5) + 2(5)\frac{dy}{dt} = 0$

$\frac{dy}{dt} = \frac{-2(12)(5)}{2(5)}$

$\frac{dy}{dt} = +12$ ft/sec

(b) Find $\frac{dA}{dt}$

$A = \frac{1}{2}xy \rightarrow \frac{dA}{dt} = \frac{1}{2}\left[x\frac{dy}{dt} + y\frac{dx}{dt}\right]$

$\frac{dA}{dt} = \frac{1}{2}\left[(12)(-12) + (5)(5)\right]$

$\frac{dA}{dt} = -\frac{119}{2}$ ft^2/sec

(c) Find $\frac{d\theta}{dt}$

$\tan\theta = \frac{y}{x} \rightarrow \sec^2\theta\frac{d\theta}{dt} = \frac{x\frac{dy}{dt} - y\frac{dx}{dt}}{x^2}$

$\left(\frac{13}{12}\right)^2\frac{d\theta}{dt} = \frac{12(-12) - 5(5)}{12^2}$

$\frac{hyp}{adj}$

$= \frac{-169}{144}$

$\frac{169}{144}$

≈ -1 rad/sec $= \frac{d\theta}{dt}$